

REMARKS

Reconsideration of this application is respectfully requested.

The amendments to claim 1 are supported in the specification as filed, for example at paragraph 67 and Figure 8A.

Submitted concurrently with this Amendment is a Declaration by Steven M. George under 37 CFR 1.132. Dr. George is a Professor in the Departments of Chemistry and Chemical Engineering at the University of Colorado at Boulder and his research focuses on fabrication, design and properties of ultrathin films and nanostructures, and in particular the use of atomic layer deposition (ALD). Declaration of Steven M. George at para. 1. His accomplishments, awards, and scholarly work is described in brief in his declaration. It is respectfully submitted that Dr. George is, at a minimum, a person of ordinary skill in the art with respect to the subject matter of the present invention.

The present claims are patentable over Park, whether considered alone or in combination with Matero. Careful study of the Park reference has revealed that Park is describing a process that is fundamentally different from that recited in claim 1. *See* Declaration of Steven M. George at paras. 13-15. Even when combined with the teachings of Matero, one does not arrive at the process recited in claim 1. Declaration of Steven M. George at para. 17.

In [0086] Park states that a 0.2 nm film was obtained by exposing a substrate to TMA for “about 0.5 sec” and then to H₂O for “about 1 sec” at 350 °C and 20 mTorr. Then, in [0087], Park states that by increasing the exposure to TMA to “about 2 sec” and continuing the exposure to H₂O for “about 1 sec”, the resulting film thickness was increased to 0.4 nm. In other words, Park has doubled the film deposition rate (as measured by film thickness per cycle) by quadrupling the exposure time to the TMA precursor.

However, as explained by Dr. George, the hallmark of an ALD process is the saturation of the film deposition rate (i.e., a lack of growth of film thickness) even in the presence of increased exposure to the precursors. *See* Declaration of Steven M. George at para. 9. Although Park recognizes this fact at [0012], the results reported in [0086]-[0087] indicate that the process being described cannot be an ALD process inasmuch as there is no saturation of the film deposition rate. Instead, the deposition rate continues to increase with the increase in exposure time to TMA. Indeed, the reported maximum growths of 0.2 and 0.4 nm are, respectively, *nearly two and four times* the accepted maximum growth rate for Al₂O₃ ALD of 0.11-0.12 nm and

suggests that additional chemical vapor deposition must have contributed to the ALD growth process. Declaration of Steven M. George at para. 14.

Claim 1 thus recites a very different process (indeed, what one might consider an *opposite* process) from that reported by Park. *See* Declaration of Steven M. George at para. 15. According to the claim, the wafer is exposed to an under-saturated dose of so-called first precursor, which is the precursor having the longer saturation time as compared to a “second” precursor. In a TMA-H₂O process, it is the H₂O which has the longer saturation time. *See* Specification at [0041], Declaration of Steven M. George at para. 15. Thus, for a TMA-H₂O process, claim 1 would require the dose of the H₂O to be “an under-saturated dose”.

Claim 1 then recites exposing the wafer to a dose of the second chemically reactive precursor, (which in a TMA - H₂O example is the TMA), where the combination of respective doses of the first and second precursors are selected to cause a saturated deposition rate for the second precursor (the TMA) being *less than* a maximum possible saturated deposition rate therefor, and being *substantially invariant* over increases in the dose of the second chemically reactive precursor.

This is distinct from Park. While the claim calls for exposing the wafer to an under-saturated dose of the precursor having the longer saturation time (e.g., H₂O) and then observing an ALD growth rate that does *not increase* for longer exposure times of the second precursor (e.g., TMA), Park describes exposing a wafer to longer exposures of TMA and observes ALD growth rates that *increase* with those longer exposure times. Simply put, this is not what is being claimed in the present application and so claim 1 is patentable over Park.

Adding the teachings of Matero et al. does not alter this conclusion. *See* Declaration of Steven M. George at para. 16. Matero indicates that while film uniformity was substantially similar for both large and small H₂O doses, the film growth rate was "substantially higher" for large H₂O doses. *See* Matero, Abstract and Section 3.1, p.3. Combining such teachings with those of Park may, at best, allow one to arrive a process where, like Park, there would be exposures to different doses of TMA and, like Matero, there would also be different doses of H₂O, but is by no means clear what the resulting process would be, other than the process would not be that recited in claim 1 of the present patent application. As indicated above, Park does not suggest a deposition rate that is substantially invariant over increases in the dose of the second chemically reactive precursor and so such teachings would still be absent from the combined teachings of these references. Furthermore, one of ordinary skill in the art may not even

contemplate combining the teachings of these references because they are concerned with fundamentally different things. Park is concerned with the effect of altering the TMA dose, while Matero is discussing the effects of altering the H₂O dose and there is no discussion of using short exposure times for the purpose of maximizing the Al₂O₃ ALD film deposition rate. Declaration of Steven M. George at para. 17.

For at least the foregoing reasons, claim 1 is patentable over Park, whether considered alone or in combination with Matero. The remaining claims depend from claim 1 and are therefore patentable over the cited references for at least the same reason as claim 1.

If there are any additional fees associated with this communication, please charge Deposit Account No.: 19-3140.

Respectfully submitted,

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